REPORT No. : SZ17070112S02

SAR TEST REPORT

APPLICANT	:	Guangdong Samzuk Technology & Development Co.,Ltd
PRODUCT NAME	:	FRS walkie talkie
MODEL NAME	:	FPDN10A, FPDN20A, FPDN30A, FPDN40A, FPDN50A, FPDN60A, FPDN70A, FPDN80A
TRADE NAME	:	N/A
BRAND NAME	:	SAMCOM
FCC ID	:	2AIOQ-FPDN10A
STANDARD(S)	:	47 CFR 2.1093 IEEE 1528-2013
ISSUE DATE	:	2017-09-07

SHENZHEN MORLAB COMMUNICATIONS TECHNOLOGY Co., Ltd.

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Change History		
Issue	Date	Reason for change
1.0	2017-09-07	First edition

TEST REPORT DECLARATION

Applicant	Guangdong Samzuk Technology & Development Co.,Ltd		
Applicant Address	High-Tech Zone Xinggong Avenue East Heyuan City, Guangdong Province, China		
Manufacturer	Guangdong Samzuk Technology & Development Co.,Ltd		
Manufacturer Address	High-Tech Zone Xinggong Avenue East Heyuan City, Guangdong Province, China		
Product Name	FRS walkie talkie		
Model Name	FPDN10A, FPDN20A, FPDN30A, FPDN40A, FPDN50A, FPDN60A, FPDN70A, FPDN80A		
Brand Name	SAMCOM		
HW Version	V1.00		
SW Version	V1.03		
Test Standards	47CFR 2.1093; IEEE 1528-2013		
Test Date	2017-07-28		
The Highest Reported 1g-SAR(W/kg)	Body	0.197W/kg (50% duty cycle)	Limit(W/kg): 1.6W/kg

Tested by : Peng Fuwei

Peng Fuwei (Test engineer)

Approved by : Peng Huarui

Peng Huarui (Supervisor)

1.TECHNICAL INFORMATION

Note: the Following data is based on the information by the applicant.

1.1 Identification of Applicant

Company Name:	Guangdong Samzuk Technology & Development Co.,Ltd
Address:	High-Tech Zone Xinggong Avenue East Heyuan City, Guangdong Province, China

1.2 Identification of Manufacturer

Company Name:	Guangdong Samzuk Technology & Development Co.,Ltd
Address:	High-Tech Zone Xinggong Avenue East Heyuan City, Guangdong Province, China

1.3 Equipment Under Test (EUT)

Model Name:	FPDN10A, FPDN20A, FPDN30A, FPDN40A, FPDN50A, FPDN60A, FPDN70A, FPDN80A
Trade Name:	N/A
Brand Name:	SAMCOM
Hardware Version:	V1.00
Software Version:	V1.03
Frequency Bands:	462.5625-467.7125MHz
Rated Power:	N/A
Antenna type:	Integral Antenna
Development Stage:	Identical prototype
Battery Model:	051850
Battery specification:	3.7V 440mAh

1.3.1 Photographs of the EUT

Please refer to the External Photos for the Photos of the EUT

1.3.2 Identification of all used EUT

The EUT identity consists of numerical and letter characters, the letter character indicates the test sample, and the Following two numerical characters indicate the software version of the test sample.

EUT Identity	Hardware Version	Software Version
1#	V1.00	V1.03

1.4 Applied Reference Documents

Leading reference documents for testing:

No.	Identity	Document Title
1	**47 CFR§2.1093**	Radiofrequency Radiation Exposure Evaluation: Portable Devices
2	**IEEE 1528-2013**	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
3	**KDB 447498 D01v06**	General RF Exposure Guidance
4	**KDB 643646 D01v01r03**	SAR Test for PTT Radios
5	**KDB 865664 D01v01r04**	SAR Measurement 100 MHz to 6 GHz
6	**KDB 865664 D02v01r02**	SAR Reporting

1.5 Device Category and SAR Limits

Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

Limits for General Population/Uncontrolled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

Note: This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for Occupational/Controlled Exposure should be applied for this device, it is 8.0 W/kg as averaged over any 1 gram of tissue.

2. SPECIFIC ABSORPTION RATE (SAR)

2.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are Middle than the limits for general population/uncontrolled.

2.2 SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density. (ρ). The equation description is as below:

$$\mathbf{SAR} = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\mathbf{dm}}\right) = \frac{\mathbf{d}}{\mathbf{dt}}\left(\frac{\mathbf{dW}}{\boldsymbol{\rho}\mathbf{dv}}\right)$$

SAR is expressed in units of Watts per kilogram (W/kg)
SAR measurement can be either related to the temperature elevation in tissue by,

$$\mathbf{SAR} = \mathbf{C}\left(\frac{\boldsymbol{\delta}\mathbf{T}}{\boldsymbol{\delta}\mathbf{t}}\right)$$

Where C is the specific head capacity, δT is the temperature rise and δt the exposure duration, or related to the electrical field in the tissue by

$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}|\mathbf{E}|^2}{\boldsymbol{\rho}}$$

Where σ is the conductivity of the tissue, ρ is the mass density of the tissue and $|E|$ is the rms electrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

3. SAR MEASUREMENT SETUP

3.1 The Measurement System

Comosar is a system that is able to determine the SAR distribution inside a phantom of human being according to different standards. The Comosar system consists of the Following items:

- Main computer to control all the system
- 6 axis robot
- Data acquisition system
- Miniature E-field probe
- Phone holder
- Head simulating tissue

The Following figure shows the system.

The EUT under test operating at the maximum power level is placed in the phone holder, under the phantom, which is filled with head simulating liquid. The E-Field probe measures the electric field inside the phantom. The OpenSAR software computes the results to give a SAR value in a 1g or 10g mass.

3.2 Probe

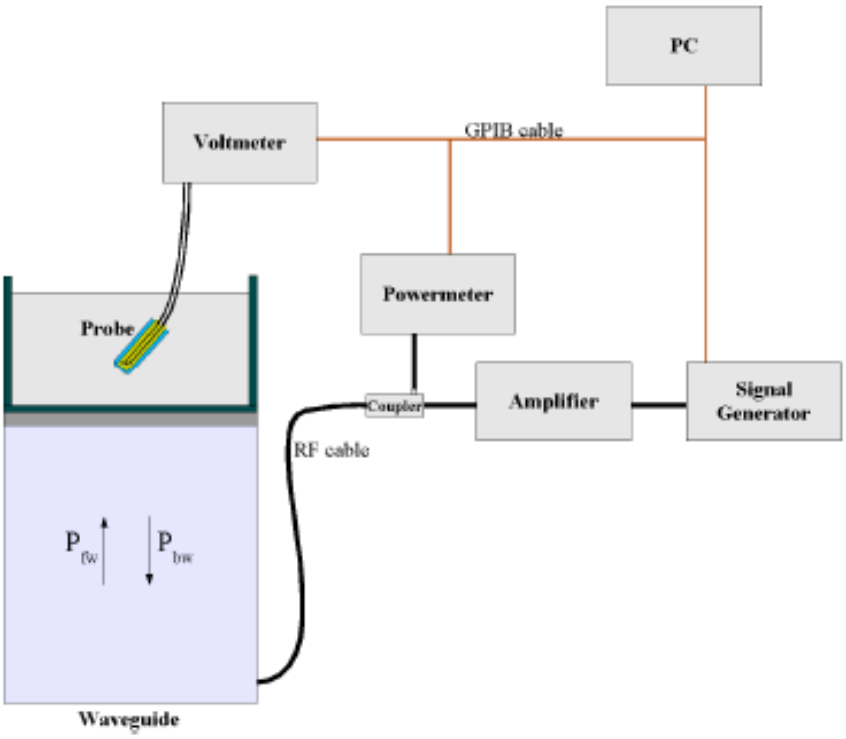
For the measurements the Specific Dosimetric E-Field Probe SN 37/08 EP80 with Following specifications is used

- Dynamic range: 0.01-100 W/kg
- Tip Diameter: 6.5 mm

- Distance between probe tip and sensor center: 2.5mm
- Distance between sensor center and the inner phantom surface: 4 mm (repeatability better than +/- 1mm)
- Probe linearity: <0.25 dB
- Axial Isotropy: <0.25 dB
- Spherical Isotropy: <0.25 dB
- Calibration range: 835to 2500MHz for head & body simulating liquid.

Angle between probe axis (evaluation axis) and surface normal line: less than 30°

Probe calibration is realized, in compliance with CENELEC EN 62209 and IEEE 1528 std, with CALISAR, Antennessa proprietary calibration system. The calibration is performed with the EN 622091 annex technique using reference guide at the five frequencies.



$$SAR = \frac{4\left(P_{fw} - P_{bw}\right)}{ab\delta} \cos^2\left(\pi \frac{y}{a}\right) e^{-(2z/\delta)}$$

Where :

Pfw = Forward Power

Pbw = Backward Power

a and b = Waveguide dimensions

ı = Skin depth

Keithley configuration:

Rate = Medium; Filter =ON; RDGS=10; FILTER TYPE =MOVING AVERAGE; RANGE AUTO
After each calibration, a SAR measurement is performed on a validation dipole and compared with a NPL calibrated probe, to verify it.

The calibration factors, CF(N), for the 3 sensors corresponding to dipole 1, dipole 2 and dipole 3 are:

$$CF(N)=SAR(N)/Vlin(N) \qquad (N=1,2,3)$$

The linearised output voltage Vlin(N) is obtained from the displayed output voltage V(N) using

$$Vlin(N)=V(N)*(1+V(N)/DCP(N)) \qquad (N=1,2,3)$$

Where DCP is the diode compression point in mV.

3.3 Probe Calibration Process

3.3.1 Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. SATIMO Probe calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm^2) using an with CALISAR, Antenna proprietary calibration system.

3.3.2 Free Space Assessment Procedure

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1 mW/cm^2.

3.3.3 Temperature Assessment Procedure

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulating head tissue. The E-field in the medium correlates with the temperature rise in the dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

Where:

δt = exposure time (30 seconds),

$$\mathbf{SAR} = \mathbf{C}\left(\frac{\delta \mathbf{T}}{\delta \mathbf{t}}\right)$$

C = heat capacity of tissue (brain or muscle),

δT = temperature increase due to RF exposure.

SAR is proportional to ΔT/Δt, the initial rate of tissue heating, before thermal diffusion takes place. The electric field in the simulated tissue can be used to estimate SAR by equating the thermally derived SAR to that with the E- field component.

$$\mathbf{SAR} = \frac{\sigma|\mathbf{E}|^2}{\rho}$$

Where:

σ = simulated tissue conductivity,

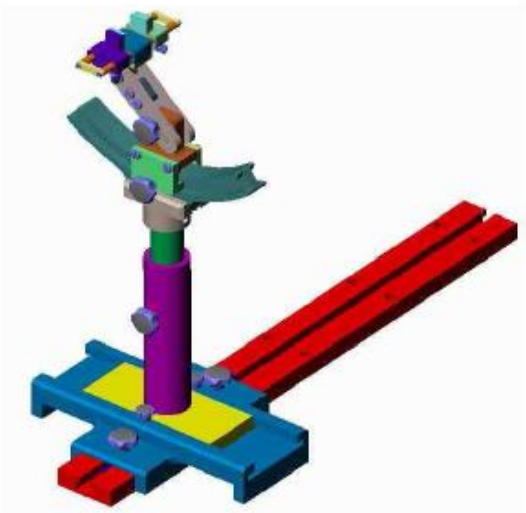
ρ = Tissue density (1.25 g/cm³ for brain tissue)

3.4 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.

3.5 Device Holder

The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is Middle than 1°.



Device holder

System Material	Permittivity	Loss Tangent
Delrin	3.7	0.005

4. TISSUE SIMULATING LIQUIDS

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in below table.

The following table gives the recipes for tissue simulating liquids

Frequency Band (MHz)	450.00	
Tissue Type	Head	Body
Ingredients (% by weight)		
Deionised Water	38.56	51.16
Salt(NaCl)	3.95	1.49
Sugar	56.32	46.78
Tween 20	0.0	0.0
HEC	0.98	0.52
Bactericide	0.19	0.05
Triton X-100	0.0	0.0
DGBE	0.0	0.0
Diethylenglycol monohexylether	0.0	0.0
Measured dielectric parameters		
Dielectric Constant	43.42	58.0
Conductivity (S/m)	0.85	0.83

Note: Please refer to the validation results for dielectric parameters of each frequency band.

The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using an Agilent 85033E Dielectric Probe Kit and an Agilent Network Analyzer.

Table 1: Dielectric Performance of Tissue Simulating Liquid

Temperature: 22.0~23.8°C, humidity: 54~60%.						
Date	**Freq.(MHz)**	**Liquid Parameters**	**Meas.**	**Target**	**Delta(%)**	**Limit±(%)**
2017/07/28	Head 450	Relative Permittivity(εr):	43.19	43.5	-0.72	5
		Conductivity(σ):	0.86	0.87	-1.16	5
	Body 450	Relative Permittivity(εr):	57.10	56.7	0.70	5
		Conductivity(σ):	0.93	0.94	-1.08	5

5. UNCERTAINTY ASSESSMENT

The Following table includes the uncertainty table of the IEEE 1528. The values are determined by Antennessa.

5.1 UNCERTAINTY EVALUATION FOR EUT SAR TEST

a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System									
Probe calibration	E.2.1	5.83	N	1	1	1	5.83	5.83	∞
Axial Isotropy	E.2.2	3.5	R	$\sqrt{3}$	1	1	2.02	2.02	∞
Hemispherical Isotropy	E.2.2	5.9	R	$\sqrt{3}$	1	1	3.41	3.41	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	E.2.4	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	E.2.5	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	E.2.6	0.5	N	1	1	1	0.5	0.5	∞
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	3.0	3.0	∞
Integration Time	E.2.8	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
RF ambient Conditions	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	E.6.2	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to Phantom Shell	E.6.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	E.5.2	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
Test sample Related									
Test sample positioning	E.4.2.1	2.6	N	1	1	1	2.6	2.6	N-1
Device Holder Uncertainty	E.4.1.1	3.0	N	1	1	1	3.0	3.0	N-1
Output power Power drift -	6.6.2	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞

SAR drift measurement									
Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	4.0	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid conductivity - deviation from target value	E.3.2	2.0	R	$\sqrt{3}$	0.64	0.43	1.69	1.13	∞
Liquid conductivity - measurement uncertainty	E.3.3	2.5	N	1	0.64	0.43	3.20	2.15	M
Liquid permittivity - deviation from target value	E.3.2	2.5	R	$\sqrt{3}$	0.6	0.49	1.28	1.04	∞
Liquid permittivity - measurement uncertainty	E.3.3	5.0	N	1	0.6	0.49	6.00	4.90	M
Liquid conductivity –temperature uncertainty	E.3.4		R	$\sqrt{3}$	0.78	0.41			∞
Liquid permittivity –temperature uncertainty	E.3.4		R	$\sqrt{3}$	0.23	0.26			∞
Combined Standard Uncertainty			RSS				11.55	12.07	
Expanded Uncertainty (95% Confidence interval)			K=2				± 23.20	± 24.17	

5.2 UNCERTAINTY FOR SYSTEM PERFORMANCE CHECK

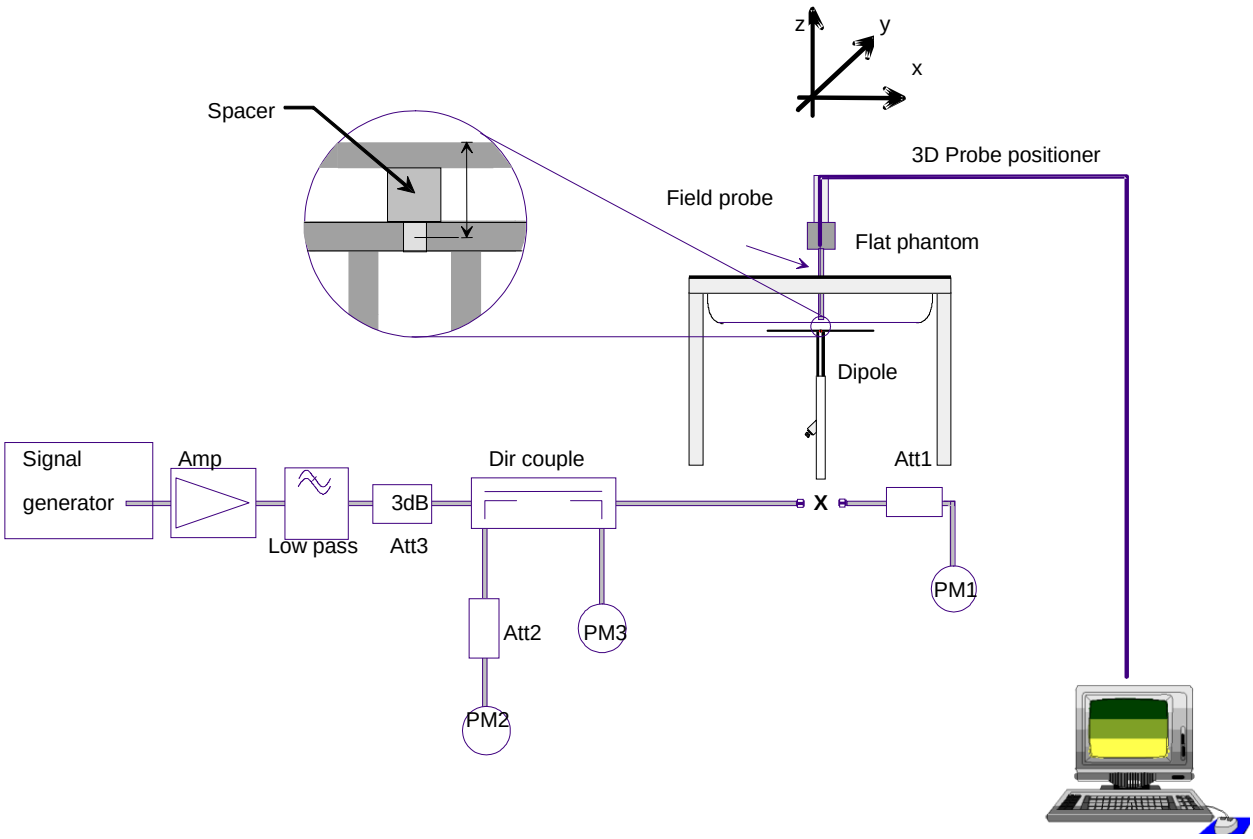
a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Sec.	Tol (+-%)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System									
Probe calibration	E.2.1	4.76	N	1	1	1	4.76	4.7	∞
Axial Isotropy	E.2.2	2.5	R	$\sqrt{3}$	1	1	1.44	1.4	∞
Hemispherical Isotropy	E.2.2	4.0	R	$\sqrt{3}$	1	1	2.31	2.3	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.5	∞
Linearity	E.2.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.8	∞

System detection limits	E.2.5	1.0	R	$\sqrt{3}$	1	1	0.58	0.5	∞
Readout Electronics	E.2.6	0.02	N	1	1	1	0.02	0.0	∞
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	1.73	1.7	∞
Integration Time	E.2.8	2.0	R	$\sqrt{3}$	1	1	1.15	1.1	∞
RF ambient Conditions	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.7	∞
Probe positioner Mechanical Tolerance	E.6.2	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Probe positioning with respect to Phantom Shell	E.6.3	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	E.5.2	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole									
Dipole axis to liquid Distance	8,E.4.2	1.00	N	$\sqrt{3}$	1	1	0.58	0.58	∞
Input power and SAR drift measurement	8,6.6.2	4.04	R	$\sqrt{3}$	1	1	2.33	2.33	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Liquid conductivity - deviation from target value	E.3.2	4.57	R	$\sqrt{3}$	0.64	0.43	1.69	1.13	∞
Liquid conductivity - measurement uncertainty	E.3.3	5.00	N	$\sqrt{3}$	0.64	0.43	1.85	1.24	M
Liquid permittivity - deviation from target value	E.3.2	3.69	R	$\sqrt{3}$	0.6	0.49	1.28	1.04	∞
Liquid permittivity - measurement uncertainty	E.3.3	10.00	N	$\sqrt{3}$	0.6	0.49	3.46	2.83	M
Combined Standard Uncertainty			RSS				8.83	8.37	
Expanded Uncertainty (95% Confidence interval)			K=2				17.66	16.73	

6. SAR MEASUREMENT EVALUATION

6.1 System Setup

In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below



The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The power meter PM1 measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz,100 mW is used for 3.5 GHz to

6 GHz) at the dipole connector and the power meter PM2 is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2.

6.2 Validation Results

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

Frequency	450MHz(H)	450MHz(B)
Target value (1g)	4.71 W/kg	4.80 W/kg
Test value (1g 250 mW input)	1.137 W/kg	1.156 W/kg
Normalized value (1g)	4.548 W/kg	4.624 W/kg

Note: System checks the specific test data please see Annex D

7. OPERATIONAL CONDITIONS DURING TEST

7.1 Information on the testing

The mobile phone antenna and battery are those specified by the manufacturer. The battery is fully charged before each measurement. The output power and frequency are controlled using a base station simulator. The mobile phone is set to transmit at its highest output peak power level.

The mobile phone is test in the “cheek” and “tilted” positions on the left and right sides of the phantom. The mobile phone is placed with the vertical centre line of the body of the mobile phone and the horizontal line crossing the centre of the earpiece in a plane parallel to the sagittal plane of the phantom.

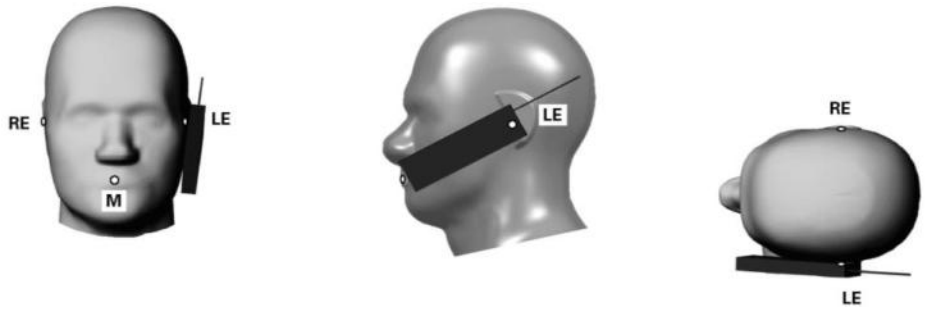


Illustration for Cheek Position

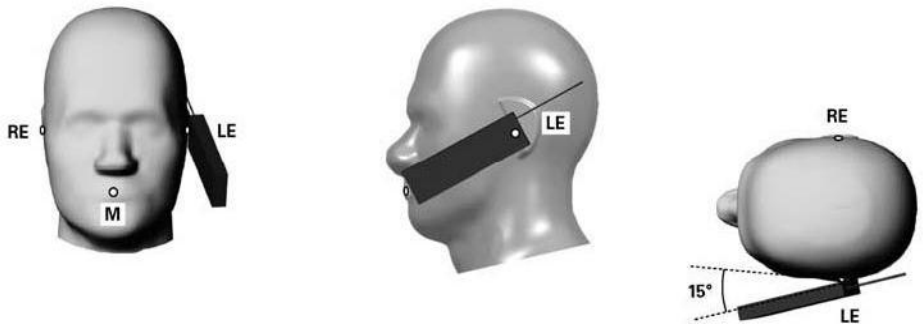


Illustration for Tilted Position

Description of the “cheek” position:

The mobile phone is well placed in the reference plane and the earpiece is in contact with the ear. Then the mobile phone is moved until any point on the front side get in contact with the cheek of the phantom or until contact with the ear is lost.

Description of the “tilted” position:

The mobile phone is well placed in the “cheek” position as described above. Then the mobile phone is moved outward away from the month by an angle of 15 degrees or until contact with the ear lost.

Remark: Please refer to Appendix B for the test setup photos.

7.2 Body-worn Configurations

The body-worn configurations shall be tested with the supplied accessories (belt-clips, holsters, etc.) attached to the device in normal use configuration.

For body-worn and other configurations a flat phantom shall be used which is comprised of material with electrical properties similar to the corresponding tissues.

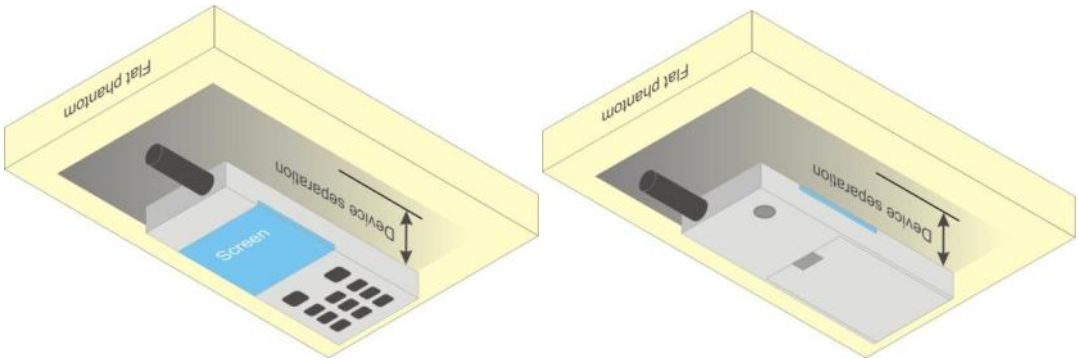


Illustration for Body Worn Position

7.3 Measurement procedure

The Following steps are used for each test position

1. Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface.
2. Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
3. Measurement of the SAR distribution with a grid of 8 to 16mm * 8 to16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.
4. Around this point, a cube of 30 * 30 * 30 mm or 32 * 32 * 32 mm is assessed by measuring 5 or

8 * 5 or 8*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

7.4 Description of interpolation/extrapolation scheme

The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimize measurements errors, but the highest local SAR will occur at the surface of the phantom.

An extrapolation is using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10 grams and 1 gram requires a very fine resolution in the three dimensional scanned data array.

9. MEASUREMENT OF CONDUCTED AVERAGE OUTPUT POWER

1. Conducted average output power

Mode	Channel	Frequency (MHz)	Highest output power(dBm)
PTT	1	462.5625	18.20
	2	462.5875	18.32
	3	462.6125	18.28
	4	462.6375	18.25
	5	462.6625	18.34
	6	462.6875	18.19
	7	462.7125	18.64
	8	467.5625	18.72
	9	467.5875	18.59
	10	467.6125	18.67
	11	467.6375	18.63
	12	467.6625	18.76
	13	467.6875	18.72
	14	467.7125	18.63

10. TEST RESULTS LIST

Summary of Measurement Results

Temperature: 21.0~23.8°C, humidity: 54~60%.						
Phantom Configurations	Frequency (MHz)	Antenna Positions	1g SAR Value(W/Kg), Limit: 1.6W/Kg			
			Measured SAR(W/Kg)	Scaling Factor	Scaled SAR(W/Kg)	50% duty cycle SAR(W/Kg)
Face toward Flat phantom (Held to face)						
Body (2.5 cm Separation)	462.5625	External	0.019	1.202	0.023	0.011
	462.6625	External	0.010	1.164	0.012	0.006
	467.6625	External	0.016	1.057	0.017	0.008
No-Speaker Cap (2.5 cm Separation)	462.5625	External	0.010	1.202	0.012	0.006
Back with belt clip toward Flat phantom (Body-worn)						
Body (direct)	462.5625	External	0.327	1.202	0.393	0.197
	462.6625	External	0.189	1.164	0.220	0.110
	467.6625	External	0.261	1.057	0.276	0.138
No-Speaker Cap (direct)	462.5625	External	0.015	1.202	0.018	0.009

Note :

1. Scaling Factor calculation

	Tune-up power tolerance (dBm)	**SAR test channel Power (dBm)**	**Scaling Factor**
Push to Talk	Max output power =18.5+-0.5	18.20	1.202
		18.34	1.164
		18.76	1.057

2. According to KDB643646 D01 v01r03, when the 1-g SAR tested using the default batter and default accessories is ≤ 0.8W/Kg (corrected by Multiplying 50% for FM mode), testing for other channels are optional.

3. For a analog PTT, only simplex communication technology was supported, so the SAR value need to be corrected by Multiplying 50%.

4. The EUT is tested by 100% duty cycle. The EUT is controlled to continue transmitting.

5. For SAR measurements, some SAR systems may have provisions to scale the measured results by means of “power scaling” to compute the 1-g SAR at a higher output power level.

$$\text{Scaling facor} = \frac{\text{Max output power(mW)}}{\text{SAR test channel Power(mW)}}$$

6. Head SAR is measured with the front surface of the radio positioned at 2.5 cm parallel to a flat phantom. Body SAR is measured with the radio placed in a body-worn accessory, positioned against a flat phantom, representative of the normal operating conditions expected by users and typically with a standard default audio accessory supplied with the radio.

11. ANNEX A PLOTS OF HIGH SAR TEST RESULTS

MEASUREMENT 1

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.7.28

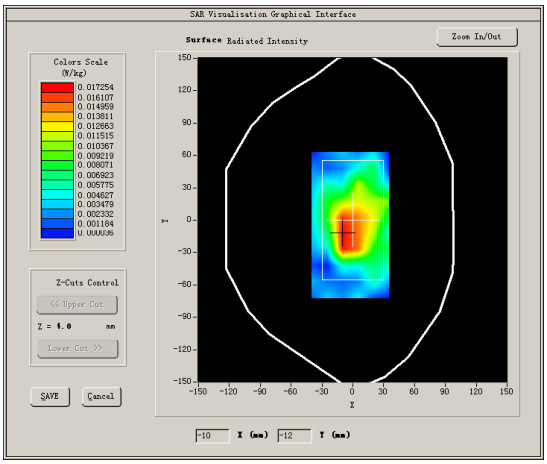
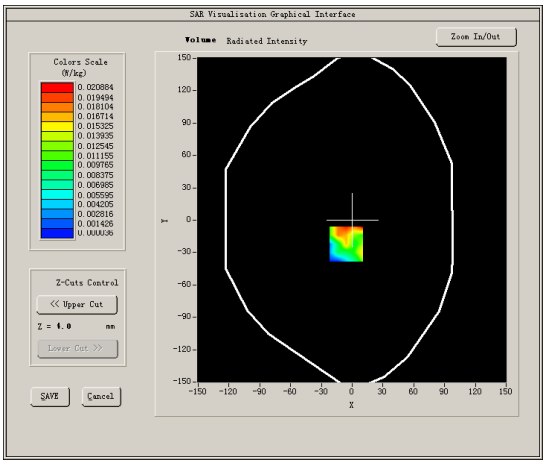
Measurement duration: 13 minutes 29 seconds

A. Experimental conditions.

Phantom File	sam_direct_droit2_surf8mm.txt
Phantom	Validation plane
Device Position	Flat phantom
Band	462.5625MHz
Channels	Ch 1
Signal	FM

B. SAR Measurement Results

Frequency (MHz)	462.5625000
Relative permittivity (real part)	43.193725
Conductivity (S/m)	0.864296
Power drift (%)	-0.5900000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.77
Crest factor:	1:1

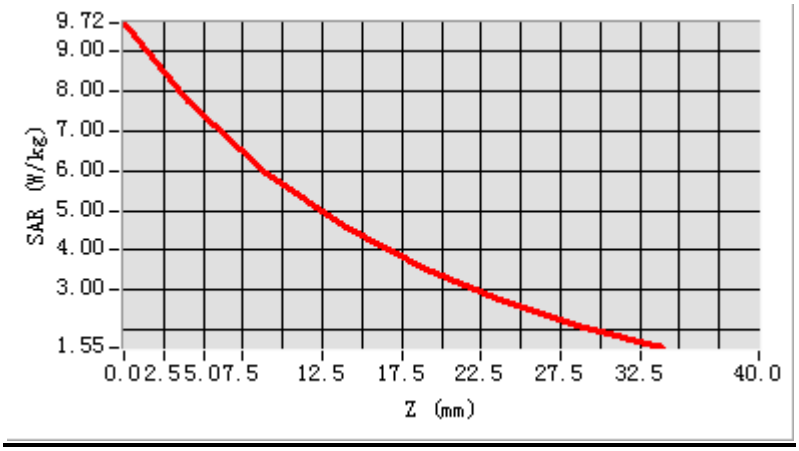
SURFACE SAR	VOLUME SAR
	

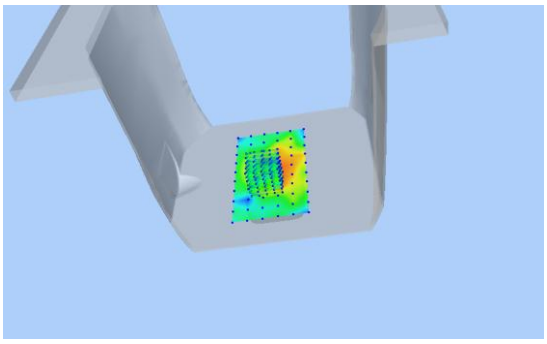
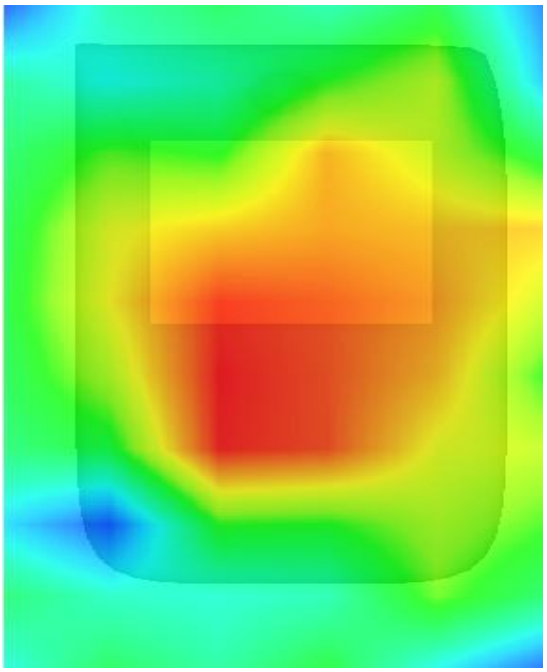
Maximum location: X=-6.00, Y=-22.00

SAR Peak: 0.04 W/kg

SAR 10g (W/Kg)	0.009657
SAR 1g (W/Kg)	0.019347

Z axis scan



3D screen shot	Hot spot position
	

MEASUREMENT 2

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.7.28

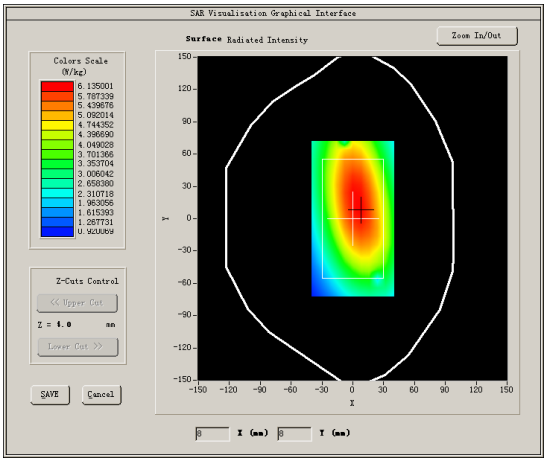
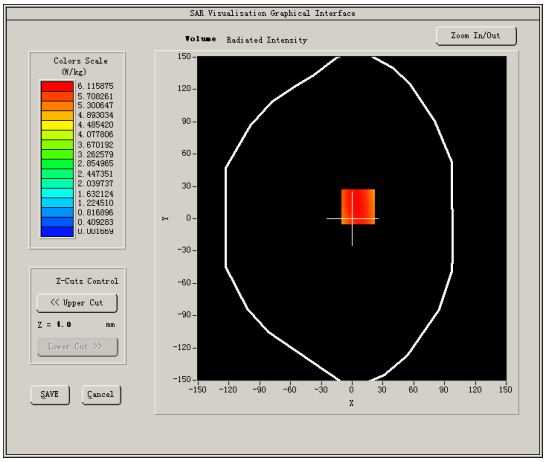
Measurement duration: 13 minutes 30 seconds

A. Experimental conditions.

Phantom File	sam_direct_droit2_surf8mm.txt
Phantom	Validation plane
Device Position	Flat phantom
Band	462.6625MHz
Channels	Ch 5
Signal	FM

B. SAR Measurement Results

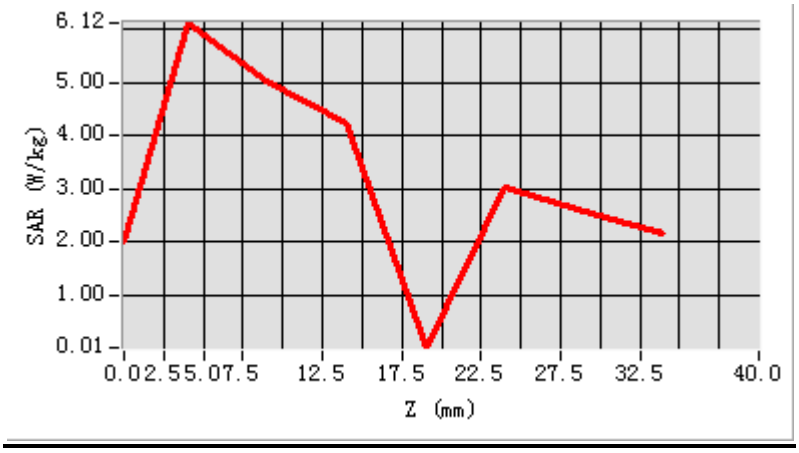
Frequency (MHz)	462.6625000
Relative permittivity (real part)	43.193725
Conductivity (S/m)	0.864296
Power drift (%)	-0.5900000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.77
Crest factor:	1:1

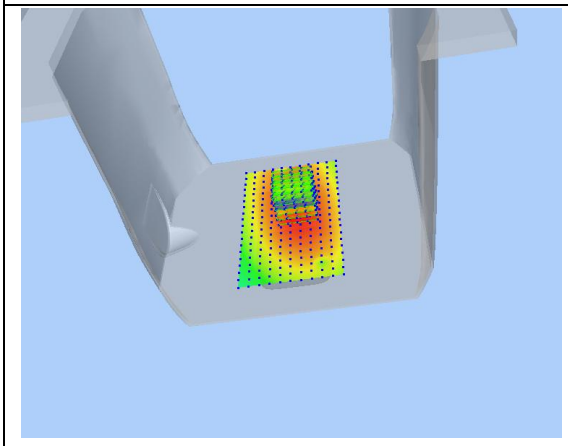
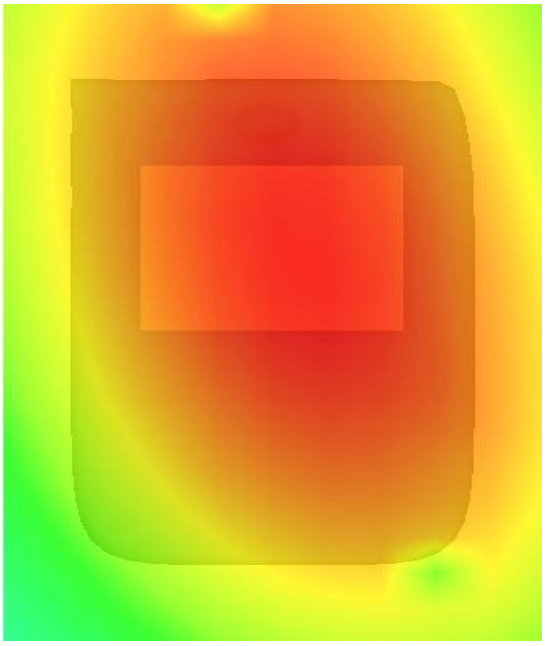
SURFACE SAR	VOLUME SAR
	

Maximum location: X=6.00, Y=11.00
SAR Peak: 7.84 W/kg

SAR 10g (W/Kg)	0.005964
SAR 1g (W/Kg)	0.009937

Z axis scan



3D screen shot	Hot spot position
	

MEASUREMENT 3

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.7.28

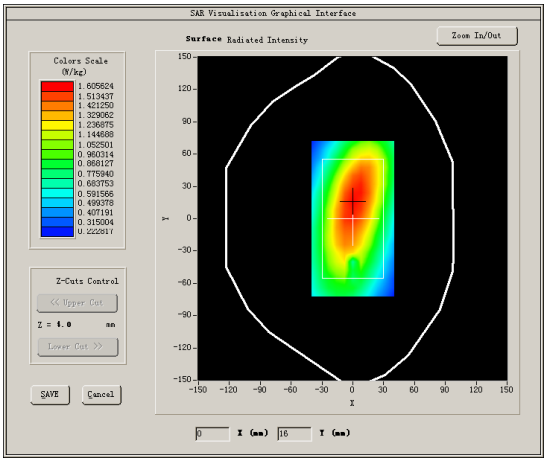
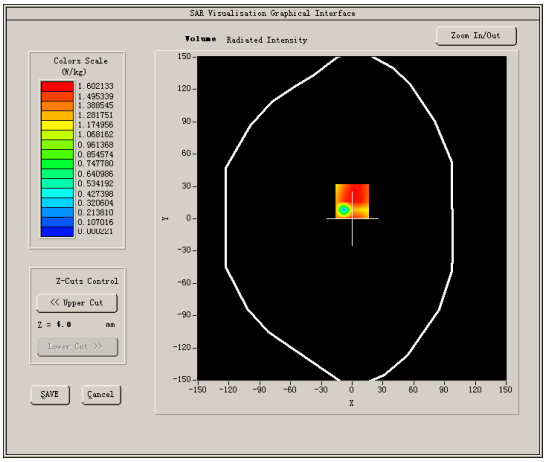
Measurement duration: 13 minutes 30 seconds

A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	Flat phantom
Band	467.6625MHz
Channels	Ch 12
Signal	FM

B. SAR Measurement Results

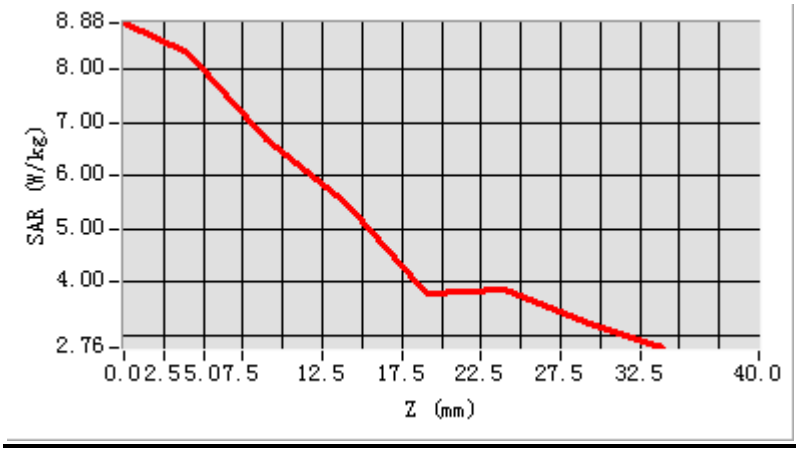
Frequency (MHz)	467.6625000
Relative permittivity (real part)	43.193725
Conductivity (S/m)	0.864296
Power drift (%)	-0.5900000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.77
Crest factor:	1:1

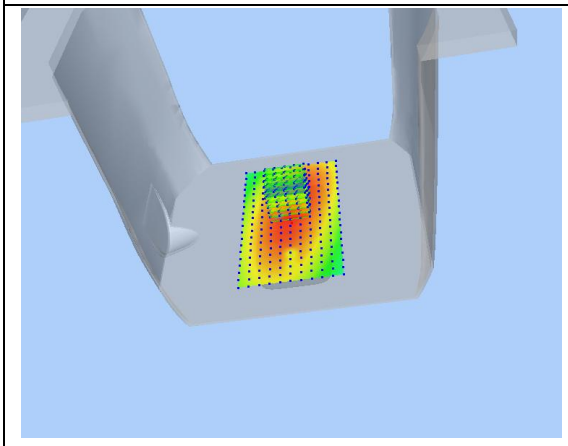
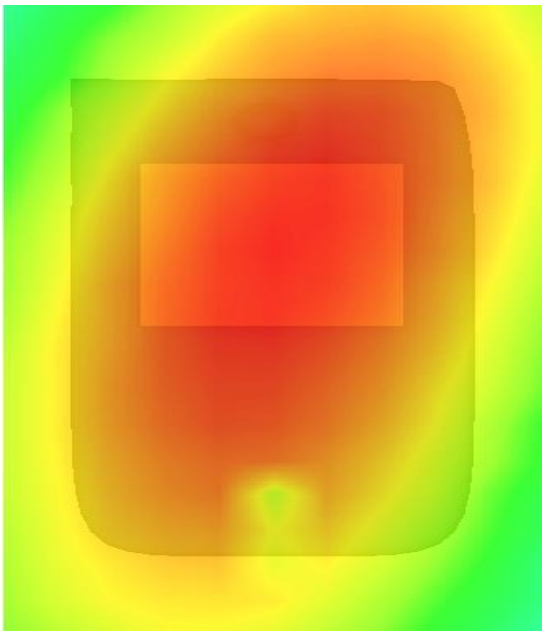
SURFACE SAR	VOLUME SAR
	

Maximum location: X=0.00, Y=16.00
SAR Peak: 6.06 W/kg

SAR 10g (W/Kg)	0.007423
SAR 1g (W/Kg)	0.015826

Z axis scan



3D screen shot	Hot spot position
	

MEASUREMENT 4

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.7.28

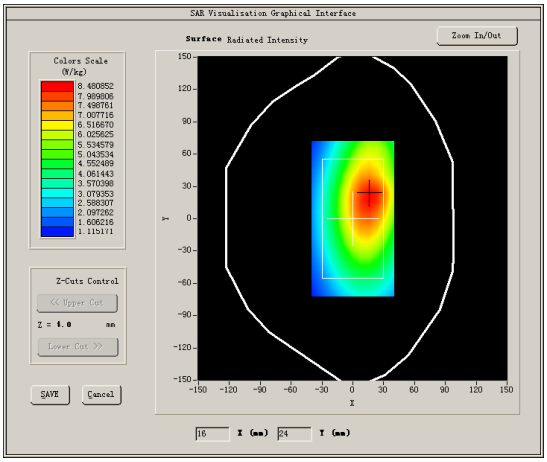
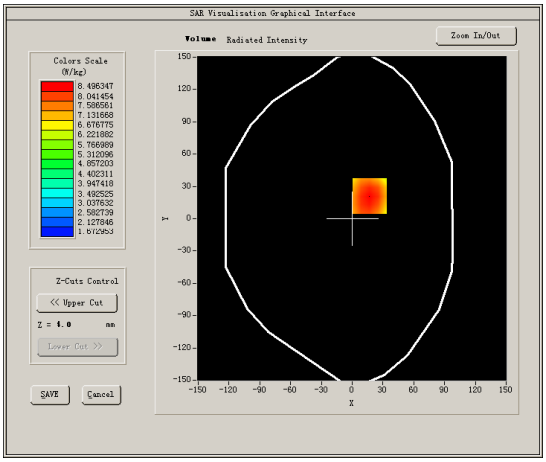
Measurement duration: 13 minutes 31 seconds

A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	Flat phantom
Band	462.5625MHz
Channels	Ch 1
Signal	FM

B. SAR Measurement Results

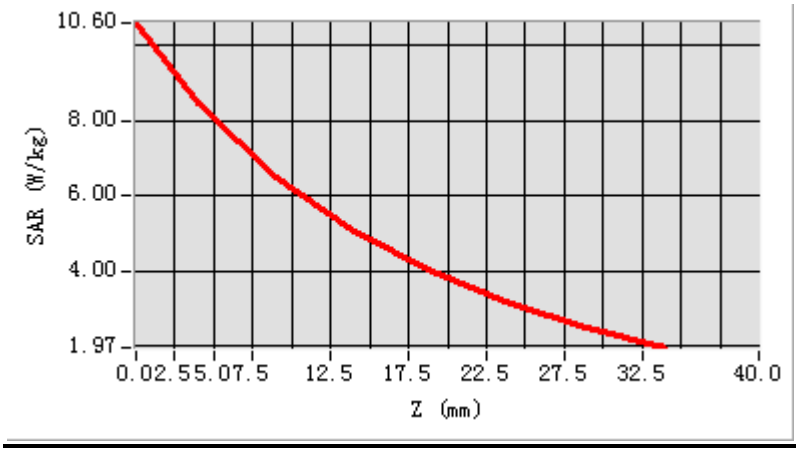
Frequency (MHz)	462.5625000
Relative permittivity (real part)	57.103725
Conductivity (S/m)	0.934296
Power drift (%)	-1.200000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.55
Crest factor:	1:1

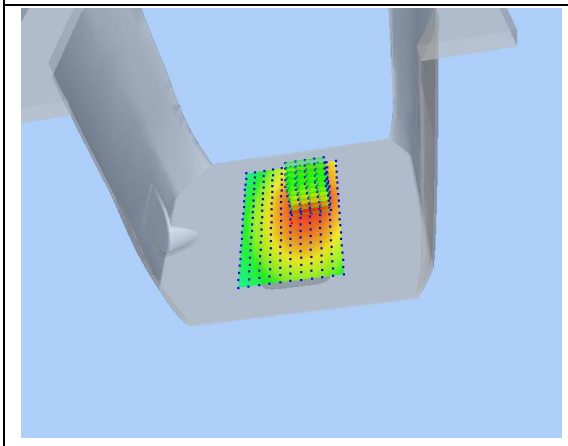
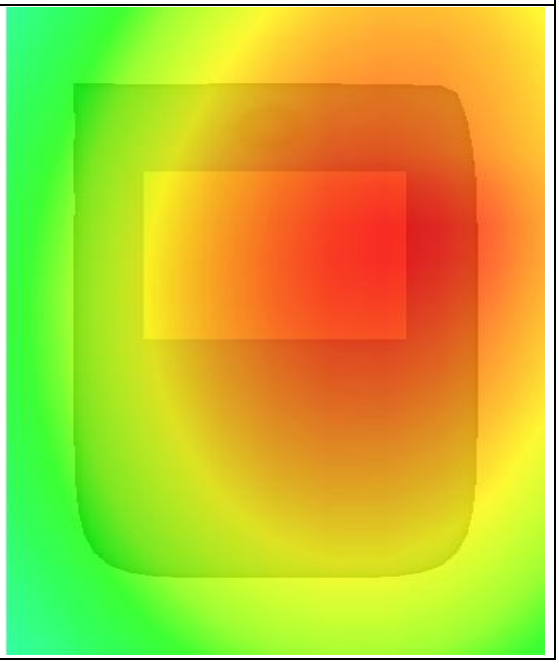
SURFACE SAR	VOLUME SAR
	

Maximum location: X=17.00, Y=21.00
SAR Peak: 5.62 W/kg

SAR 10g (W/Kg)	0.159236
SAR 1g (W/Kg)	0.327352

Z axis scan



3D screen shot	Hot spot position
	

MEASUREMENT 5

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.7.28

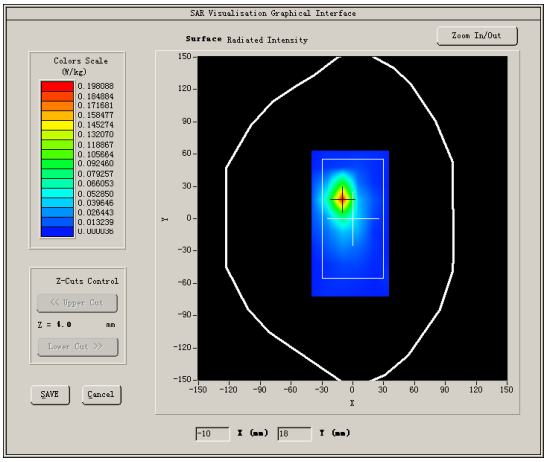
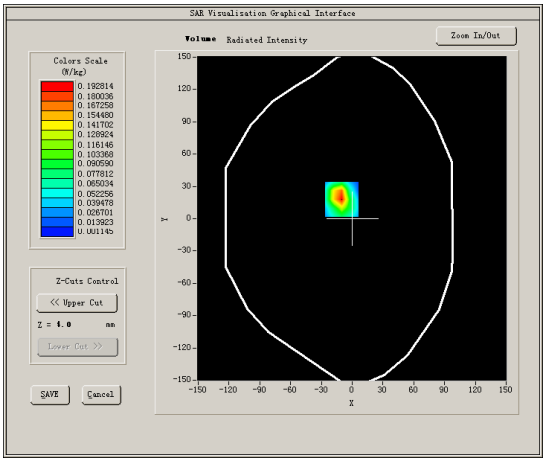
Measurement duration: 13 minutes 30 seconds

A. Experimental conditions.

Phantom File	sam_direct_droit2_surf8mm.txt
Phantom	Validation plane
Device Position	Flat phantom
Band	462.6625MHz
Channels	Ch 5
Signal	FM

B. SAR Measurement Results

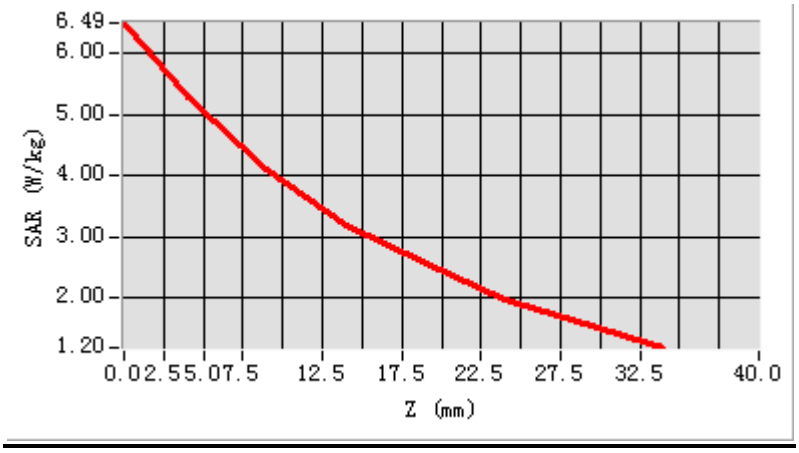
Frequency (MHz)	462.6625000
Relative permittivity (real part)	57.103725
Conductivity (S/m)	0.934296
Power drift (%)	-1.200000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.55
Crest factor:	1:1

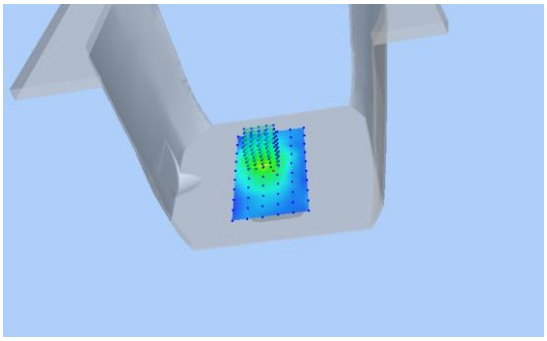
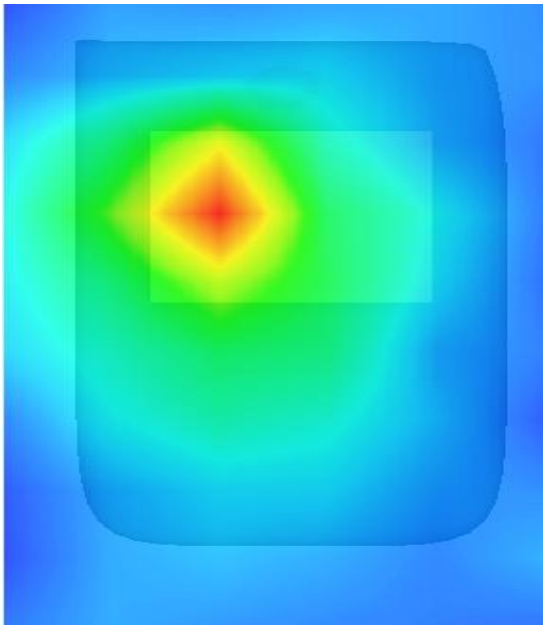
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-10.00, Y=18.00
SAR Peak: 0.41 W/kg

SAR 10g (W/Kg)	0.075188
SAR 1g (W/Kg)	0.188690

Z axis scan



3D screen shot	Hot spot position
	

MEASUREMENT 6

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.7.28

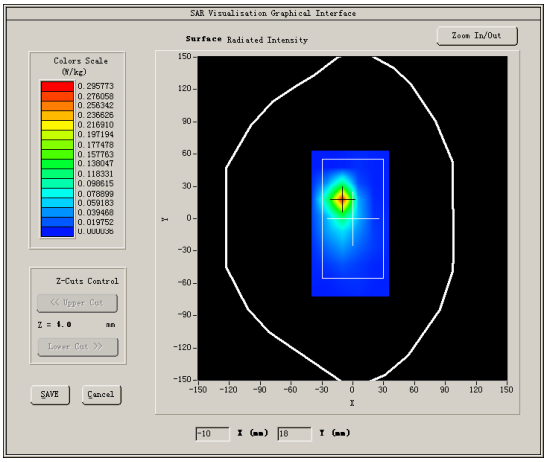
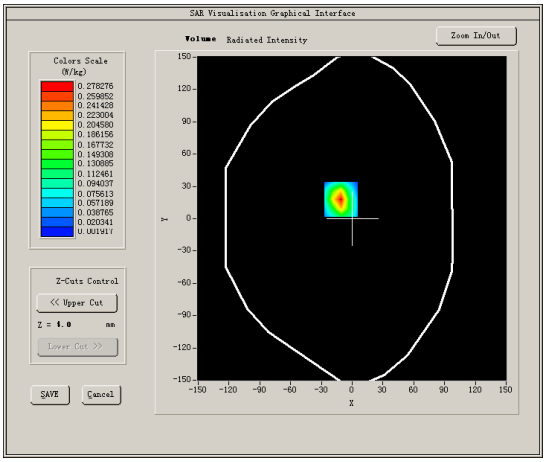
Measurement duration: 13 minutes 30 seconds

A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	Flat phantom
Band	467.6625MHz
Channels	Ch 12
Signal	FM

B. SAR Measurement Results

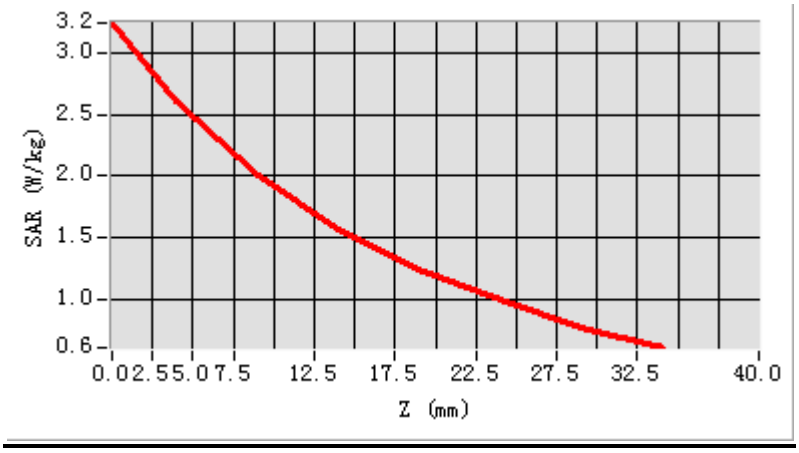
Frequency (MHz)	467.6625000
Relative permittivity (real part)	57.103725
Conductivity (S/m)	0.934296
Power drift (%)	-1.200000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.55
Crest factor:	1:1

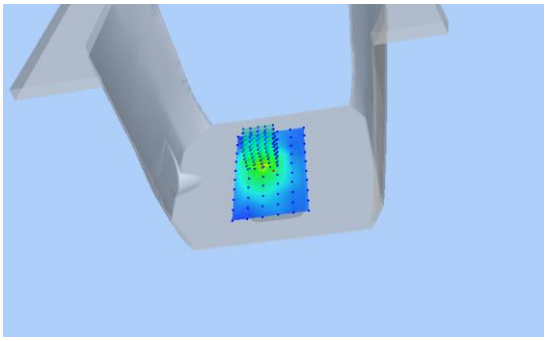
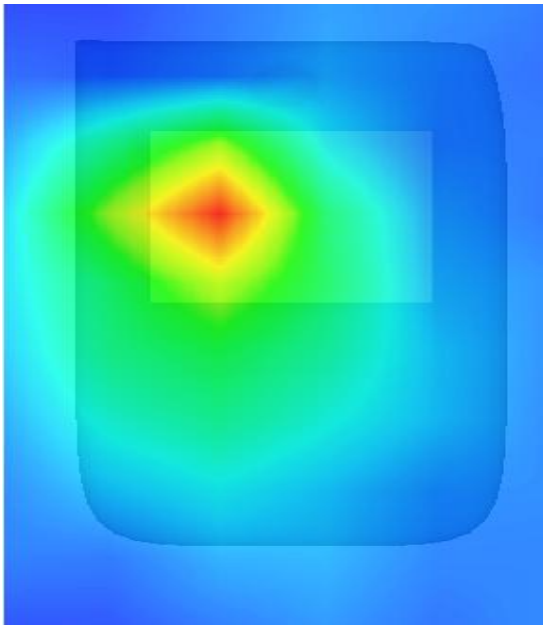
SURFACE SAR	VOLUME SAR
	

Maximum location: X=-11.00, Y=18.00
SAR Peak: 0.55 W/kg

SAR 10g (W/Kg)	0.106536
SAR 1g (W/Kg)	0.260746

Z axis scan



3D screen shot	Hot spot position
	

MEASUREMENT 7

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.09.06

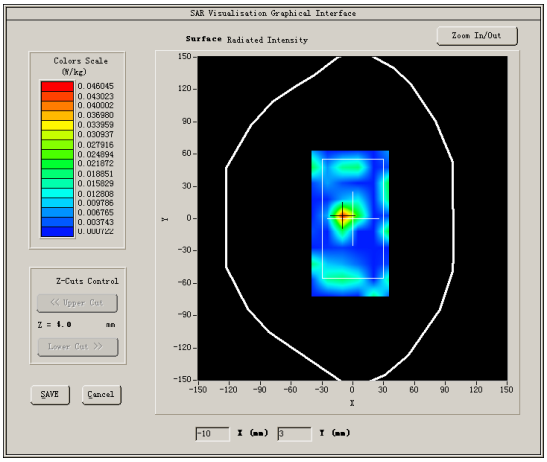
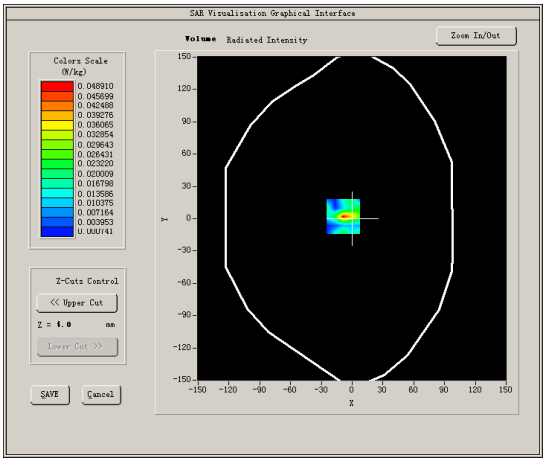
Measurement duration: 13 minutes 15 seconds

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Flat phantom
Band	462.5625MHz
Channels	Ch 1
Signal	FM

B. SAR Measurement Results

Frequency (MHz)	462.5625000
Relative permittivity (real part)	57.103725
Conductivity (S/m)	0.934296
Power drift (%)	-1.200000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.55
Crest factor:	1:1

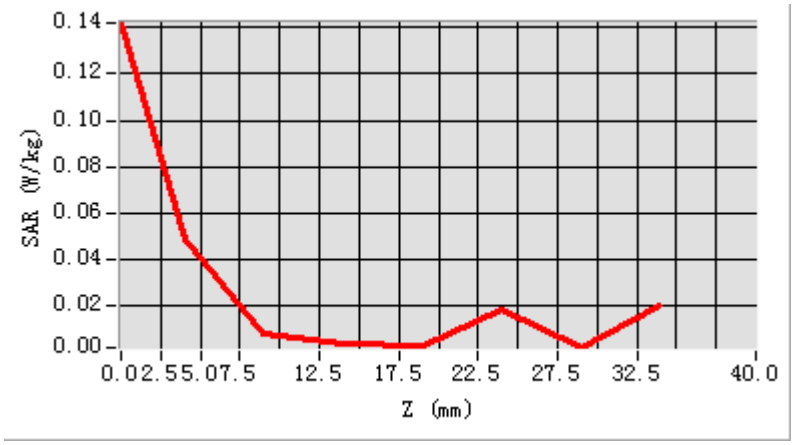
SURFACE SAR	VOLUME SAR
	

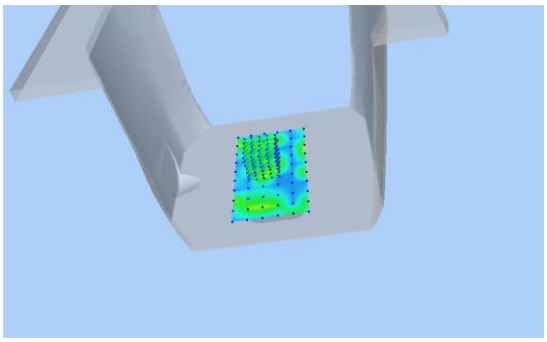
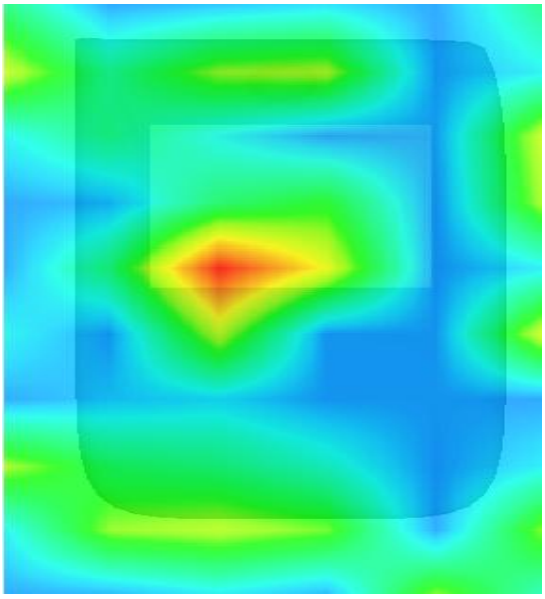
Maximum location: X=-9.00, Y=2.00

SAR Peak: 0.14 W/kg

SAR 10g (W/Kg)	0.007286
SAR 1g (W/Kg)	0.014078

Z (mm)	**0.00**	**4.00**	**9.00**	**14.00**	**19.00**	**24.00**	**29.00**
SAR (W/Kg)	**0.1421**	**0.0489**	**0.0078**	**0.0036**	**0.0022**	**0.0178**	**0.0017**



3D screen shot	**Hot spot position**
	

MEASUREMENT 8

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.09.06

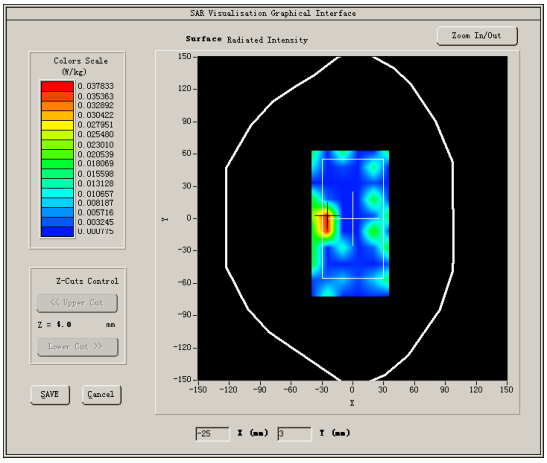
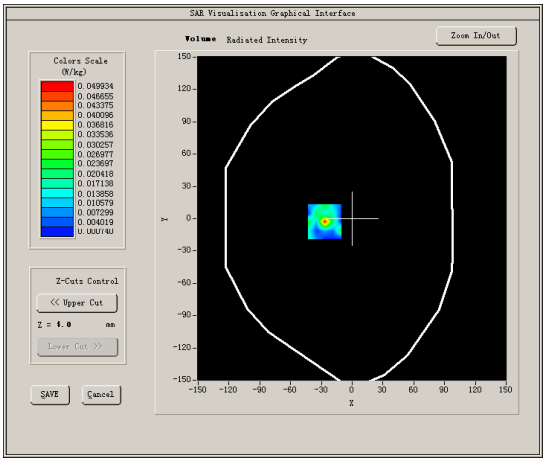
Measurement duration: 13 minutes 13 seconds

A. Experimental conditions.

Area Scan	surf_sam_plan.txt, h= 5.00 mm
Phantom	Validation plane
Device Position	Flat phantom
Band	462.5625MHz
Channels	Ch 1
Signal	FM

B. SAR Measurement Results

Frequency (MHz)	462.5625000
Relative permittivity (real part)	43.193725
Conductivity (S/m)	0.864296
Power drift (%)	-0.5900000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.77
Crest factor:	1:1

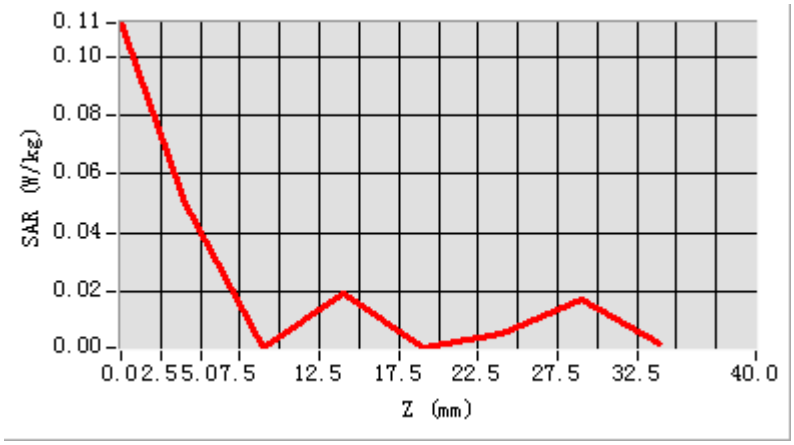
SURFACE SAR	VOLUME SAR
	

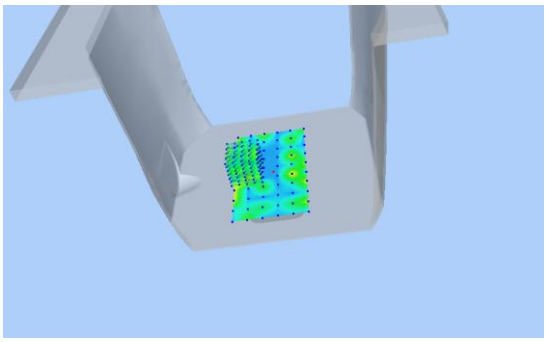
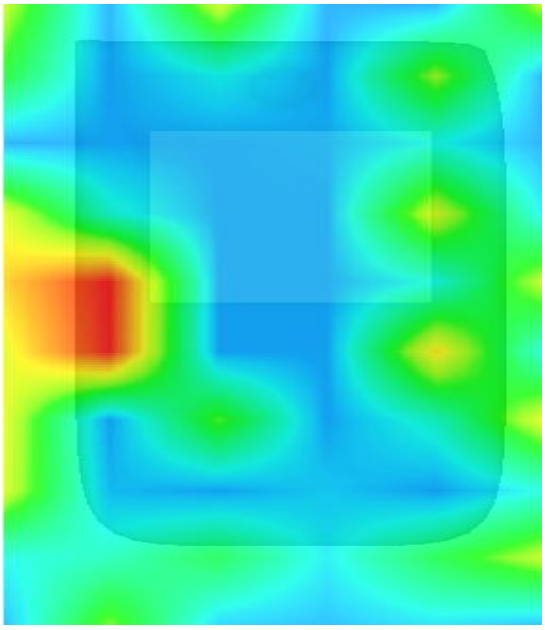
Maximum location: X=-27.00, Y=-3.00

SAR Peak: 0.12 W/kg

SAR 10g (W/Kg)	0.006128
SAR 1g (W/Kg)	0.010304

Z (mm)	**0.00**	**4.00**	**9.00**	**14.00**	**19.00**	**24.00**	**29.00**
SAR (W/Kg)	**0.1116**	**0.0499**	**0.0008**	**0.0192**	**0.0009**	**0.0055**	**0.0170**



3D screen shot	**Hot spot position**
	

12. ANNEX B SYSTEM CHECK DATA

450MHz System Check Data(Head)

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.7.28

Measurement duration: 13 minutes 27 seconds

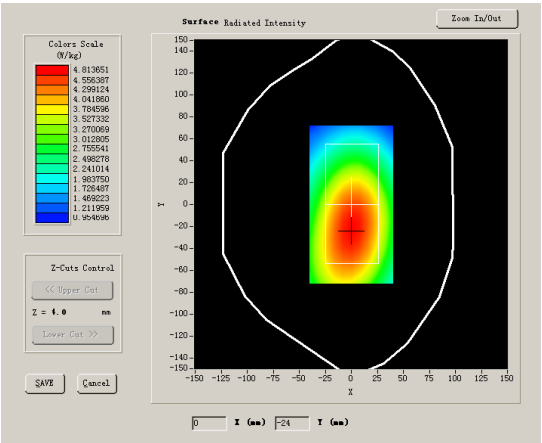
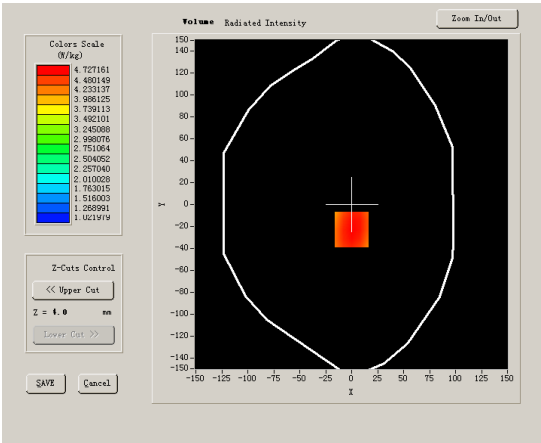
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	
Band	450MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	450.000000
Relative permittivity (real part)	43.193725
Conductivity (S/m)	0.864296
Power Drift (%)	-0.5900000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.77
Crest factor:	1:1

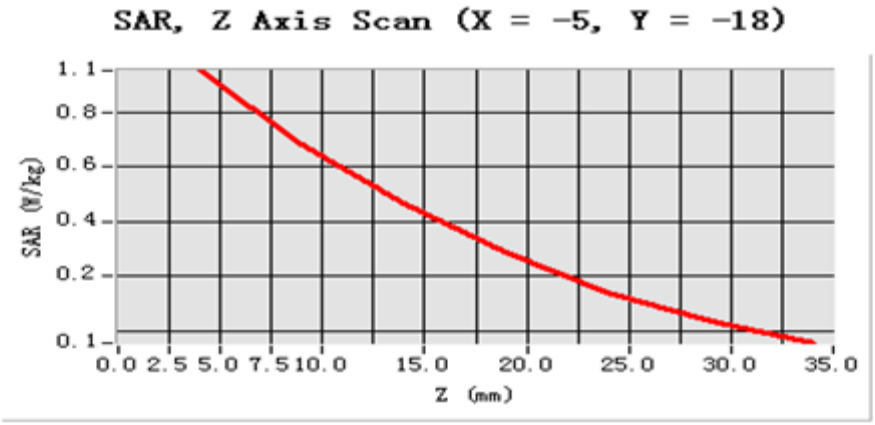
SURFACE SAR	VOLUME SAR
	

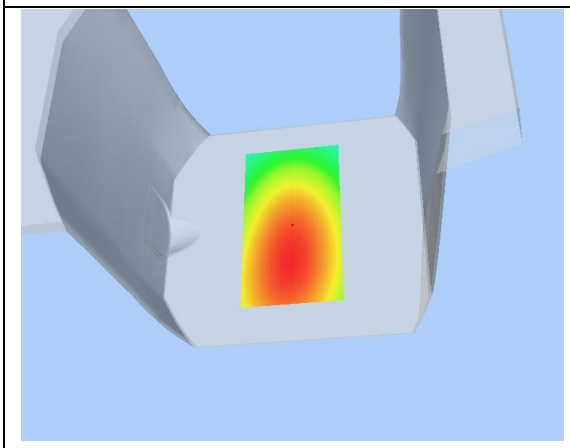
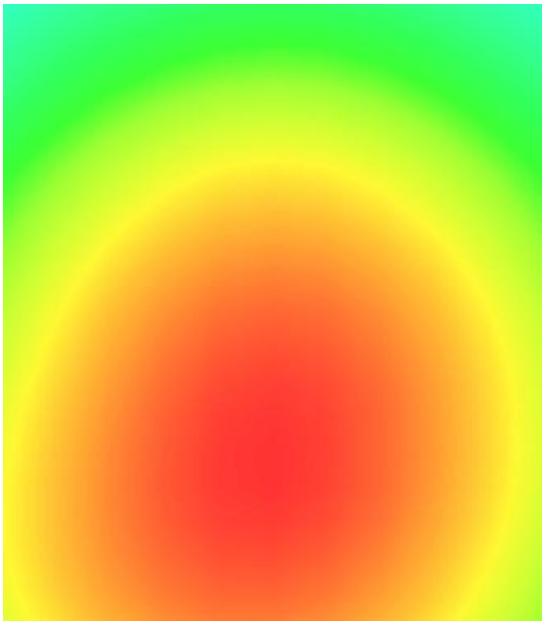
Maximum location: X=-5.00, Y=-18.00

SAR 10g (W/Kg)	0.637619
SAR 1g (W/Kg)	1.037291

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	1.0545	0.7926	0.49865	0.2764	0.1972	0.1328



3D sceen shot	Hot spot position
	

450MHz System Check Data(Body)

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.7.28

Measurement duration: 13 minutes 27 seconds

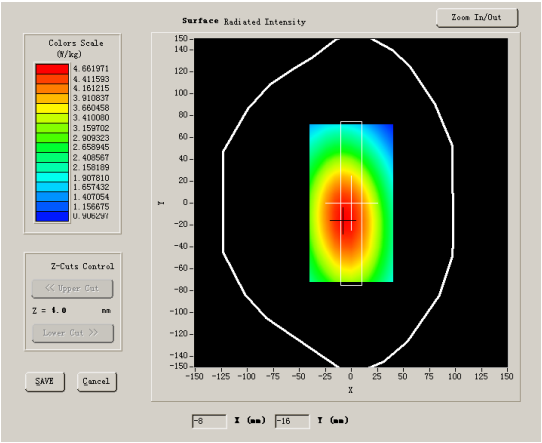
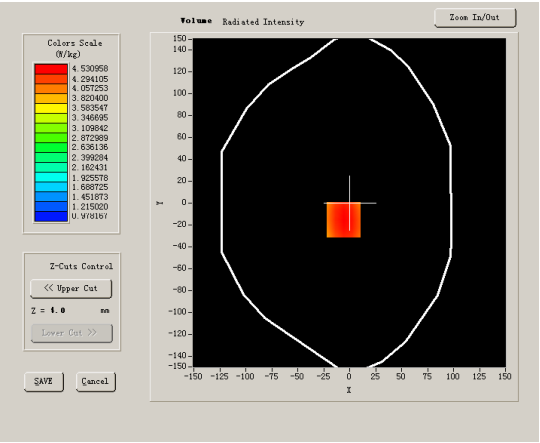
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	
Band	450MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	450.000000
Relative permittivity (real part)	57.103725
Conductivity (S/m)	0.934296
Power Drift (%)	-1.200000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.55
Crest factor:	1:1

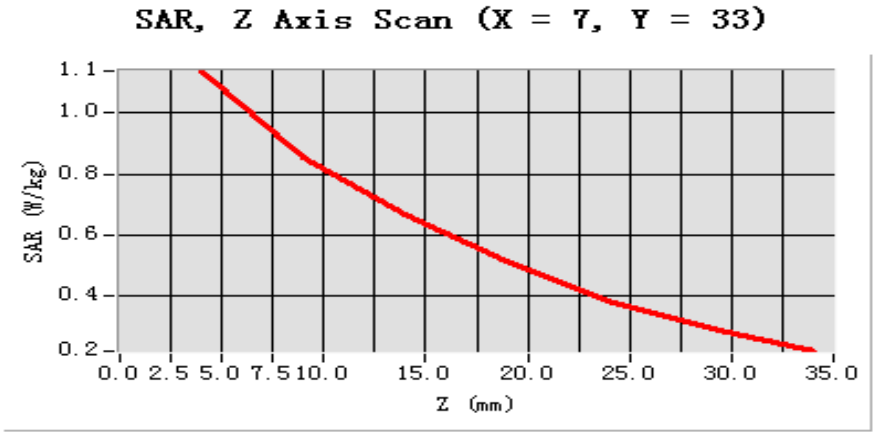
SURFACE SAR	VOLUME SAR
	

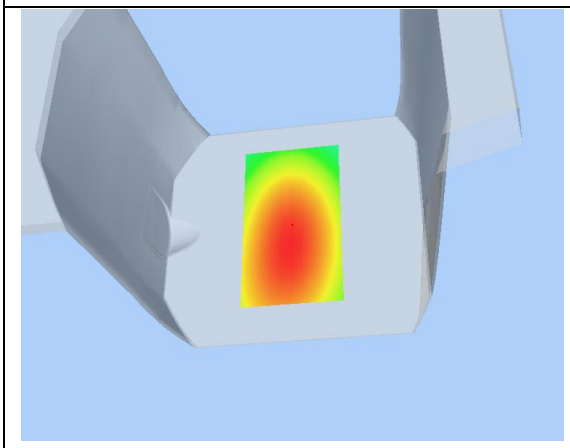
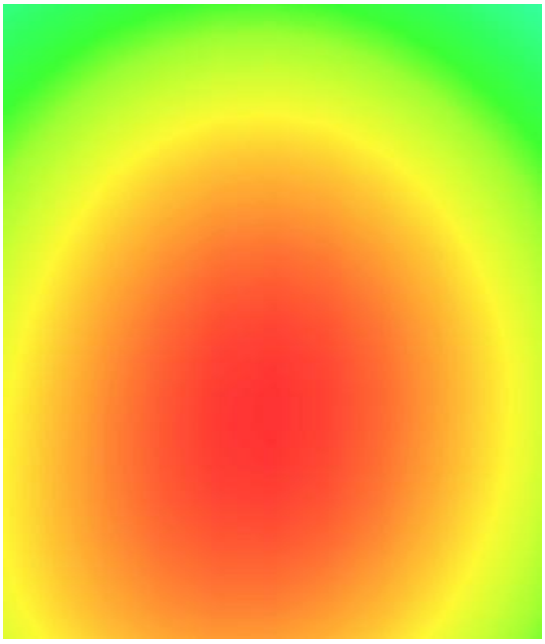
Maximum location: X=7.00, Y=33.00

SAR 10g (W/Kg)	0.706428
SAR 1g (W/Kg)	1.156247

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	1.1038	0.9671	0.7264	0.5926	0.3061	0.2140



3D sceen shot	Hot spot position
	

450MHz System Check Data(Head)

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.9.06

Measurement duration: 13 minutes 27 seconds

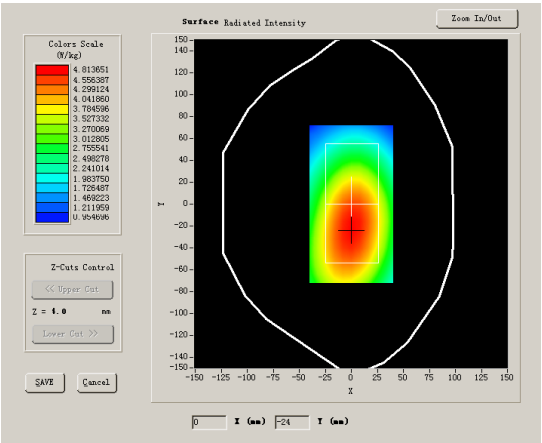
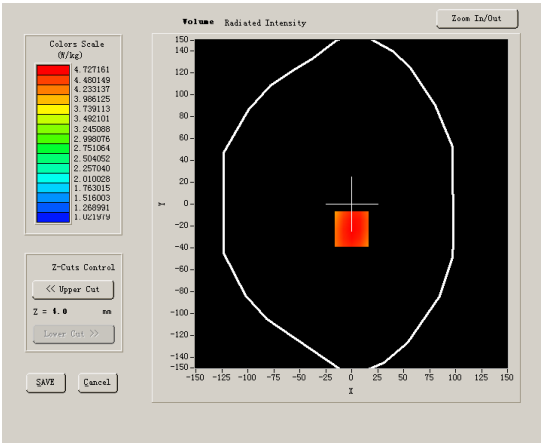
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	
Band	450MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	450.000000
Relative permittivity (real part)	43.193725
Conductivity (S/m)	0.864296
Power Drift (%)	-0.5900000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.77
Crest factor:	1:1

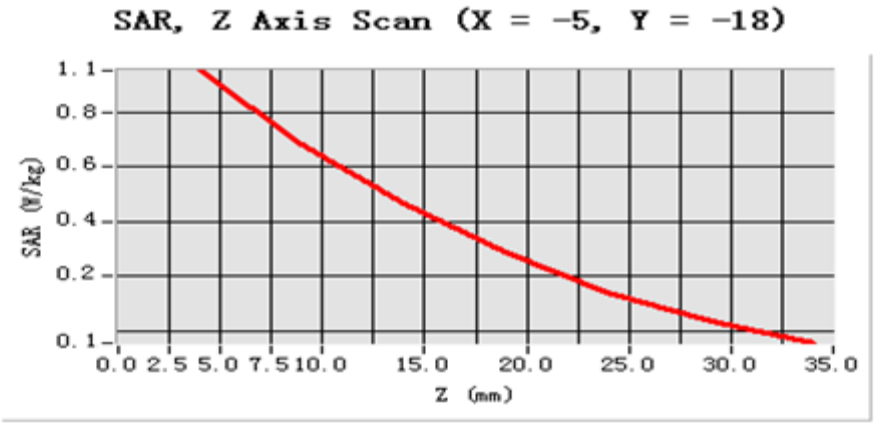
SURFACE SAR	VOLUME SAR
	

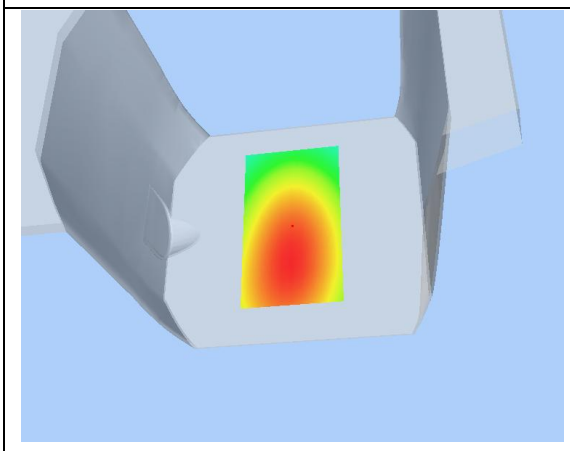
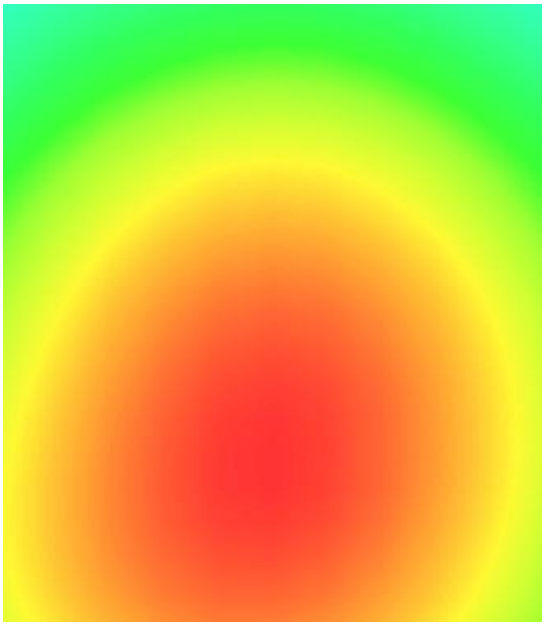
Maximum location: X=-5.00, Y=-18.00

SAR 10g (W/Kg)	0.637619
SAR 1g (W/Kg)	1.037291

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	1.0545	0.7926	0.49865	0.2764	0.1972	0.1328



3D sceen shot	Hot spot position
	

450MHz System Check Data(Body)

Type: Phone measurement (Complete)

Area scan resolution: dx=8mm,dy=8mm

Zoom scan resolution: dx=8mm, dy=8mm, dz=5mm

Date of measurement: 2017.9.06

Measurement duration: 13 minutes 27 seconds

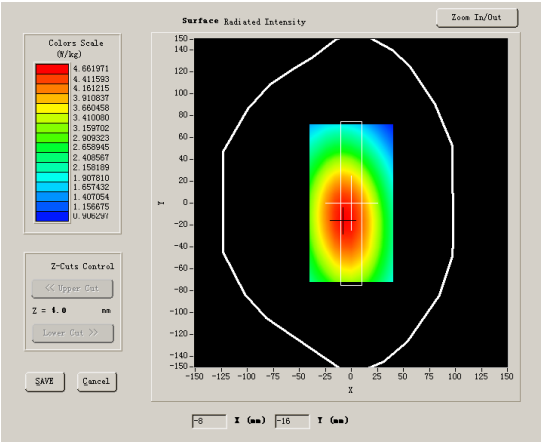
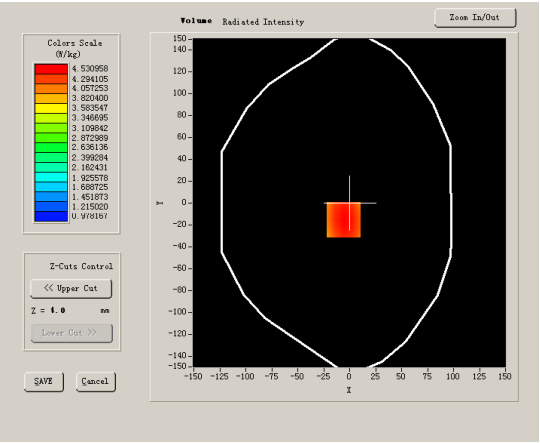
A. Experimental conditions.

Phantom File	surf_sam_plan.txt
Phantom	Validation plane
Device Position	
Band	450MHz
Channels	
Signal	CW

B. SAR Measurement Results

Band SAR

Frequency (MHz)	450.000000
Relative permittivity (real part)	57.103725
Conductivity (S/m)	0.934296
Power Drift (%)	-1.200000
Ambient Temperature:	22.3°C
Liquid Temperature:	22.6°C
ConvF:	7.55
Crest factor:	1:1

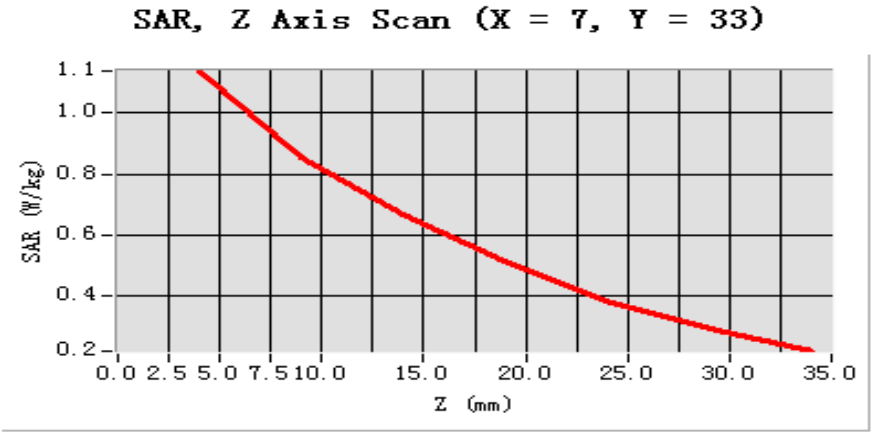
SURFACE SAR	VOLUME SAR
	

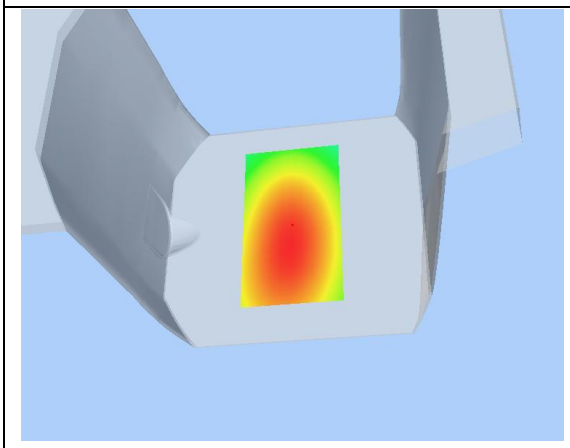
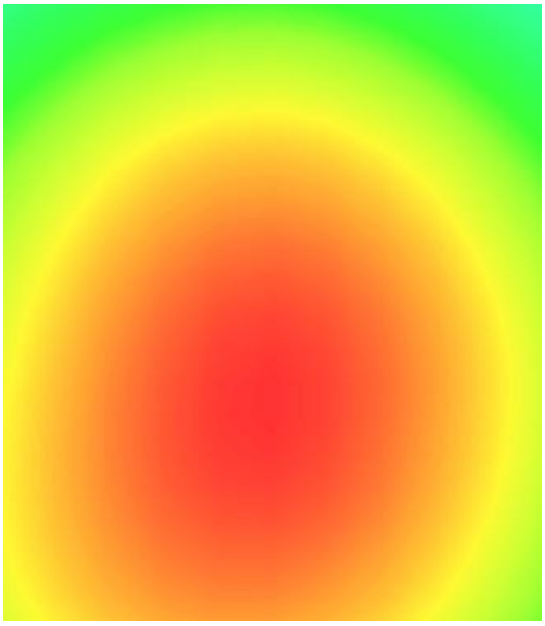
Maximum location: X=7.00, Y=33.00

SAR 10g (W/Kg)	0.706428
SAR 1g (W/Kg)	1.156247

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	1.1038	0.9671	0.7264	0.5926	0.3061	0.2140



3D sceen shot	Hot spot position
	

13. ANNEX C GENERAL INFORMATION

1. Identification of the Responsible Testing Laboratory

Company Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Department:	Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Responsible Test Lab Manager:	Mr. Su Feng
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

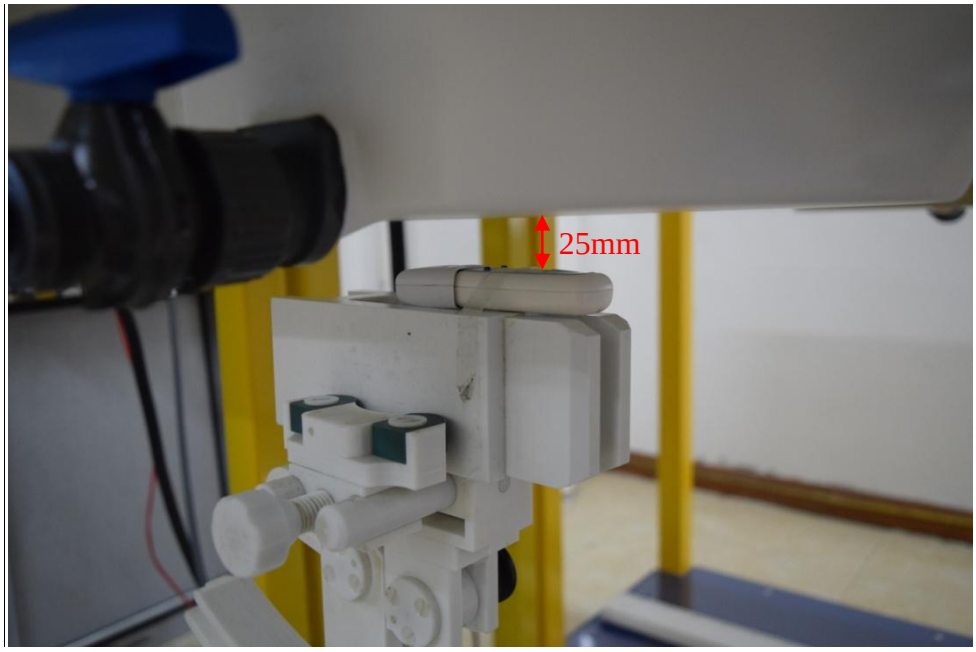
Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. List of Test Equipments

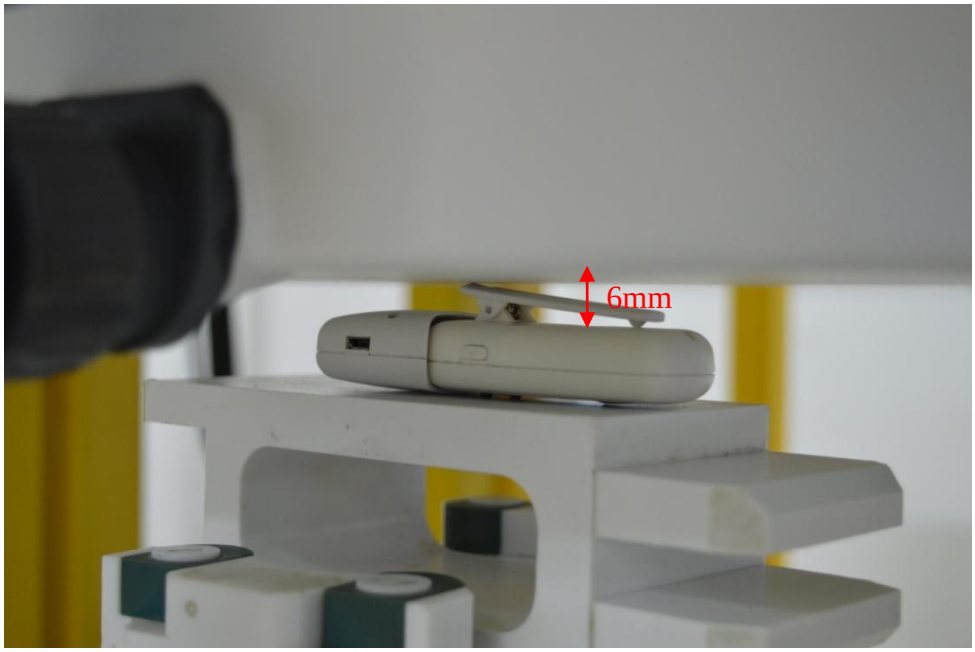
No.	Instrument	Type	Cal. Date	Cal. Due
1	PC	Dell (Pentium IV 2.4GHz, SN:X10-23533)	(n.a)	(n.a)
2	Network Analyzer	Agilent(E5071B ,SN:MY42404762)	2017-7-5	1year
3	Voltmeter	Keithley (2000, SN:1000572)	2017-7-5	1year
4	Signal Generator	Rohde&Schwarz (SMP_02)	2017-7-5	1year
5	Power Amplifier	PRANA (Ap32 SV125AZ)	2017-7-5	1year
6	Power Meter	Agilent (E4416A, SN:MY45102093)	2017-7-5	1year
7	Power Sensor	Agilent (N8482A, SN:MY41091706)	2017-7-5	1year
8	Directional coupler	Giga-tronics(SN:1829112)	2017-7-5	1year
9	Probe	Satimo (SN:SN 37/08 EP80)	2017-7-5	1year
10	Dielectric Probe Kit	Agilent (85033E)	2017-7-5	1year
11	Phantom	Satimo (SN:SN_36_08_SAM62)	N/A	N/A
12	Liquid	Satimo(Last Calibration: 2017-7-28)	N/A	N/A
13	Liquid	Satimo(Last Calibration: 2017-9-06)	N/A	N/A
14	Dipole 450MHz	Satimo (SN 36/08 DIPB98)	2017-7-5	1year

14. ANNEX D EUT TEST POSITION PHOTOS

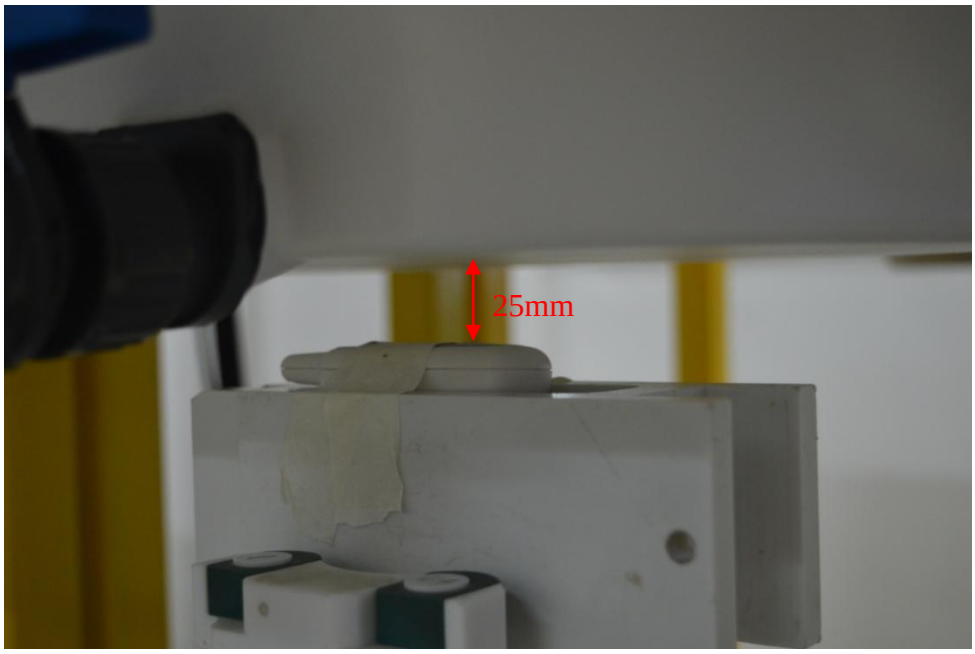
1. Hold to face condition



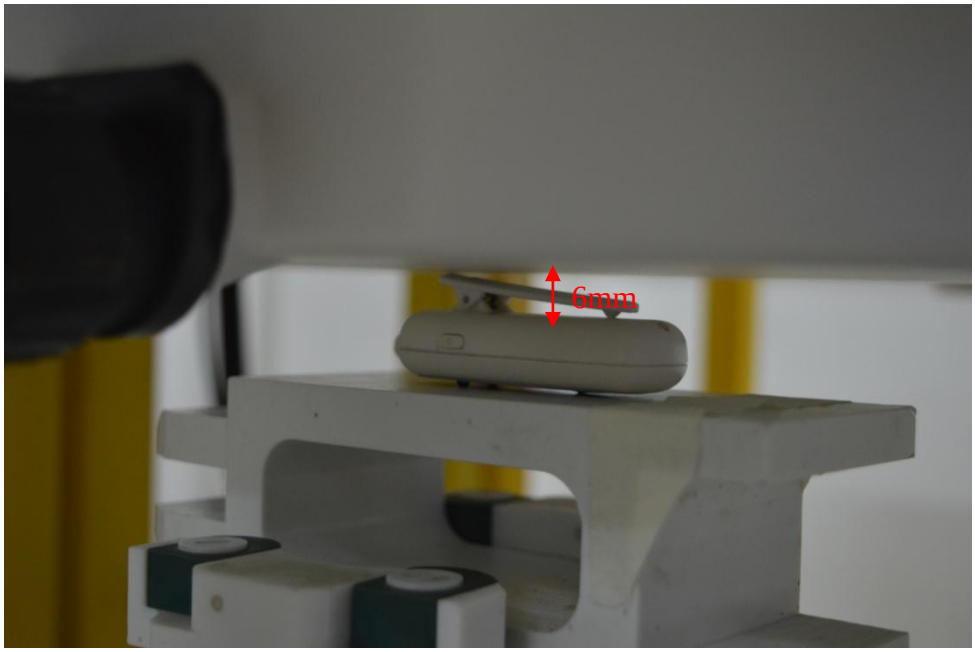
2. Body-worn condition



3. No-Speaker Cap Hold to face condition



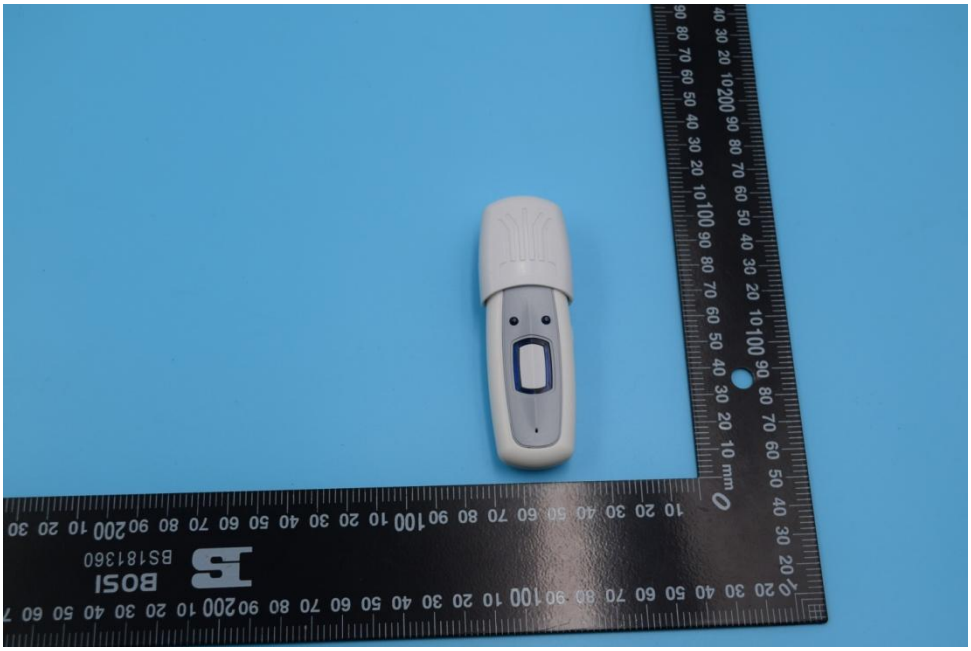
4. No-Speaker Cap Body-worn condition



5. Liquid Level Photo Body Liquid

Liquid depth :15.5cm

6. EUT Front View



7. EUT Back View

8. Uncovered View

***** END OF REPORT *****